Meeting with Alliance/Global Automakers

Powertrain efficiency in EPA's technical assessment to-date, and plans for ongoing updates

September 21, 2017
Office of Transportation and Air Quality
National Vehicle and Fuel Emissions Laboratory

High-level Summary of Alliance comments based on Novation Analytics review of 2016 EPA powertrain modeling

Alliance comment 1

LPM does not account for engine operating load over the test cycles, and therefore incorrectly projects technology effectiveness when operating loads differ from the exemplar vehicles'

Alliance comment 2

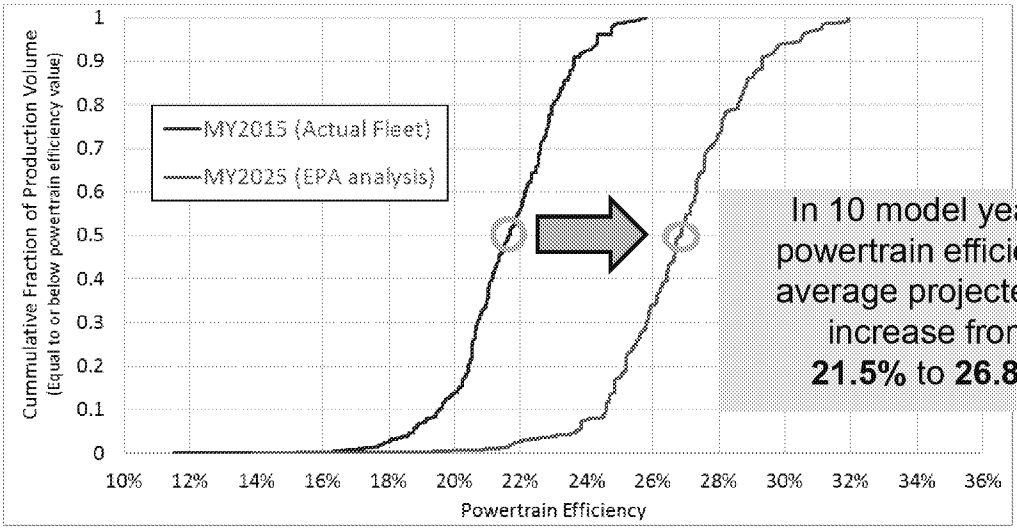
LPM outputs should be screened using energy efficiency metrics

Alliance comment 3

Recent rate of powertrain efficiency improvement is not sufficient to meet MY2025 GHG standards

Review of EPA's 2016 PD Results using Powertrain Efficiency Metrics

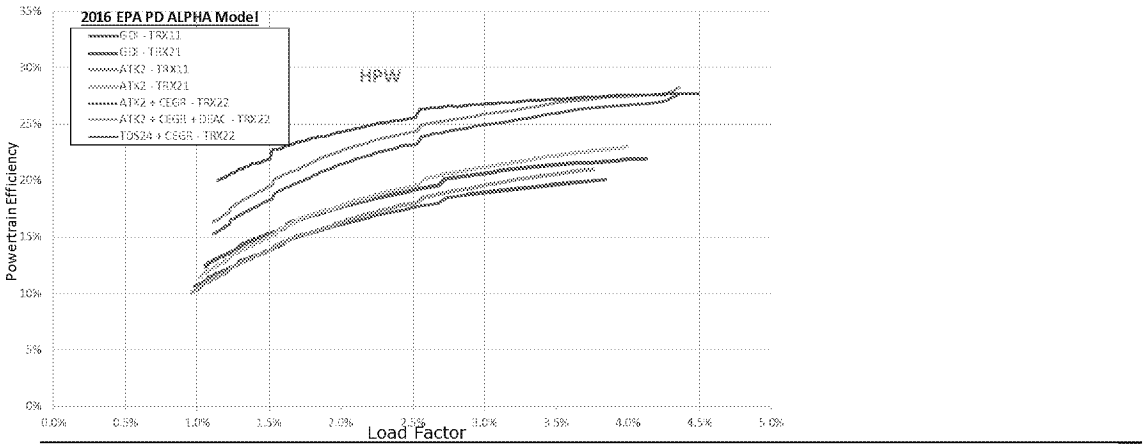
2016 EPA Proposed Determination: Baseline vs. Future Gasoline Powertrain Efficiency



In 10 model years, powertrain efficiency average projected to increase from **21.5%** to **26.8%**

2016 EPA Proposed Determination: Accounting for Operating Load in ALPHA and LPM

- ALPHA model results project lower powertrain efficiencies as the ratio of operating load to engine power decreases



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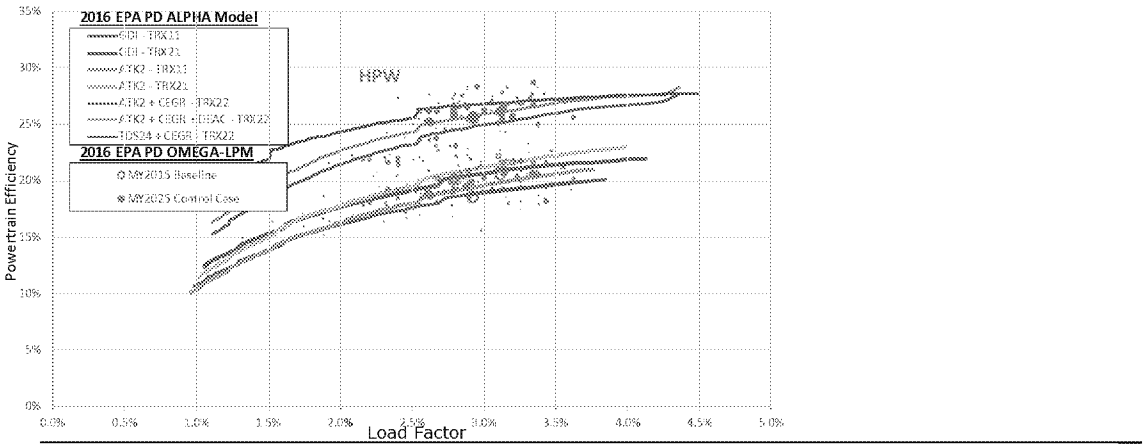
- OMEGA-LPM effectiveness values for MY2025 packages are generally within the bounds of powertrain efficiencies modeled in ALPHA
  - Small proportion of vehicles exceed ALPHA modeled powertrain efficiencies due to baseline technology characterization and road load coefficients and emissions values reported by certification test group.



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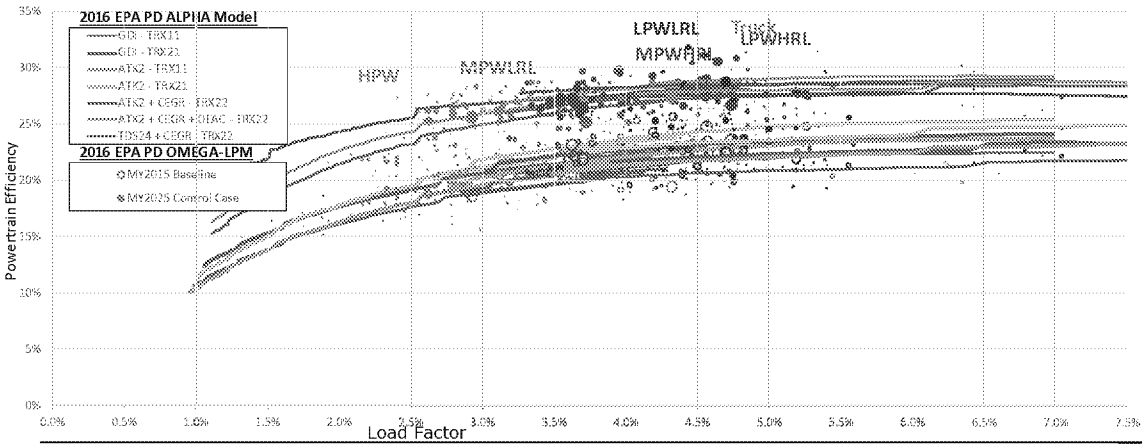
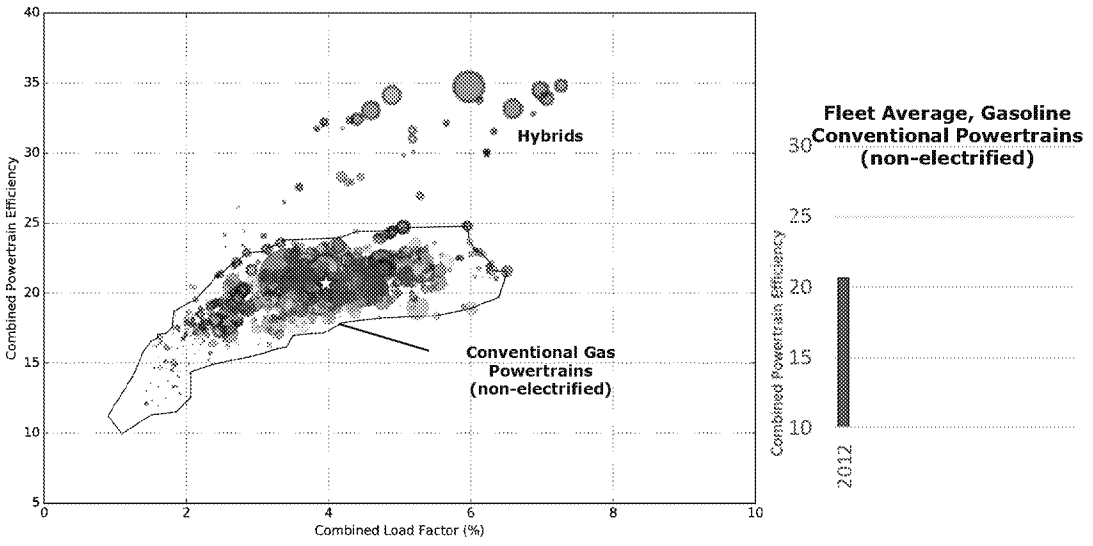
  - Small proportion of vehicles exceed ALPHA modeled powertrain efficiencies due to baseline technology characterization and road load coefficients and emissions values reported by certification test group.
- The same findings apply across all six ALPHA classes

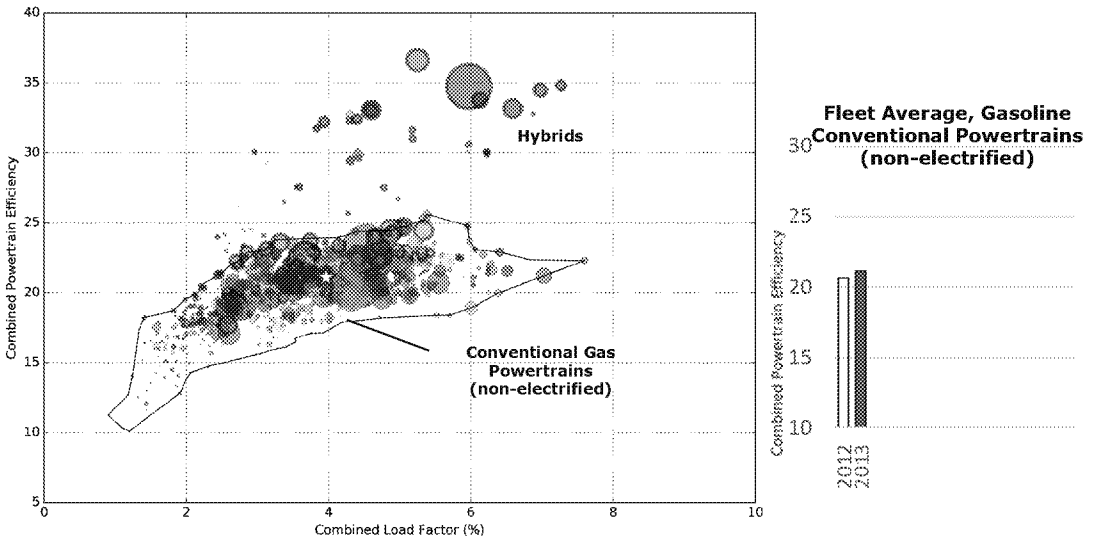


Fleet Powertrain Efficiency 2012-2016

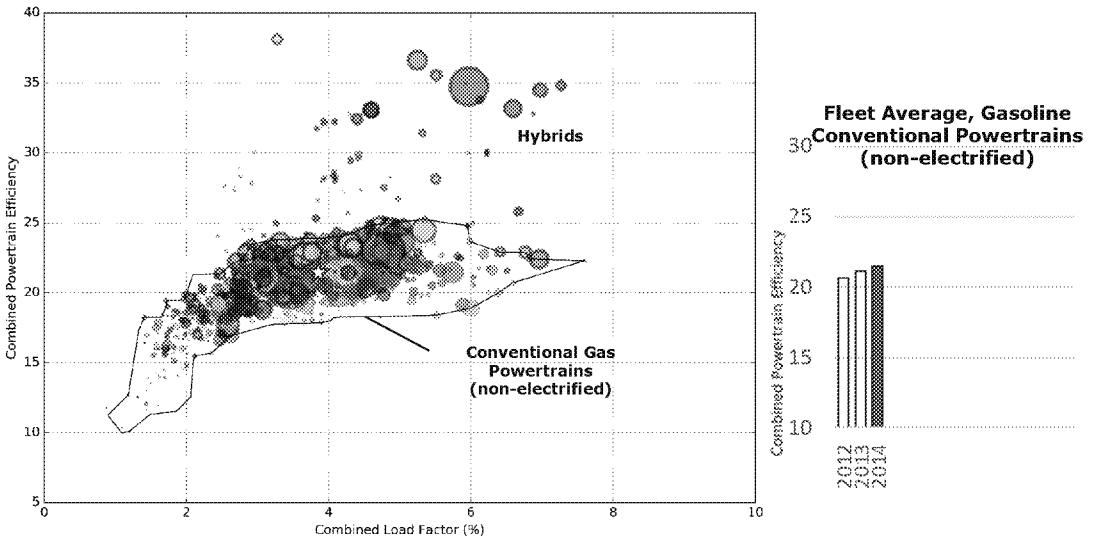
Distribution of Fleet Powertrain Efficiencies MY2012



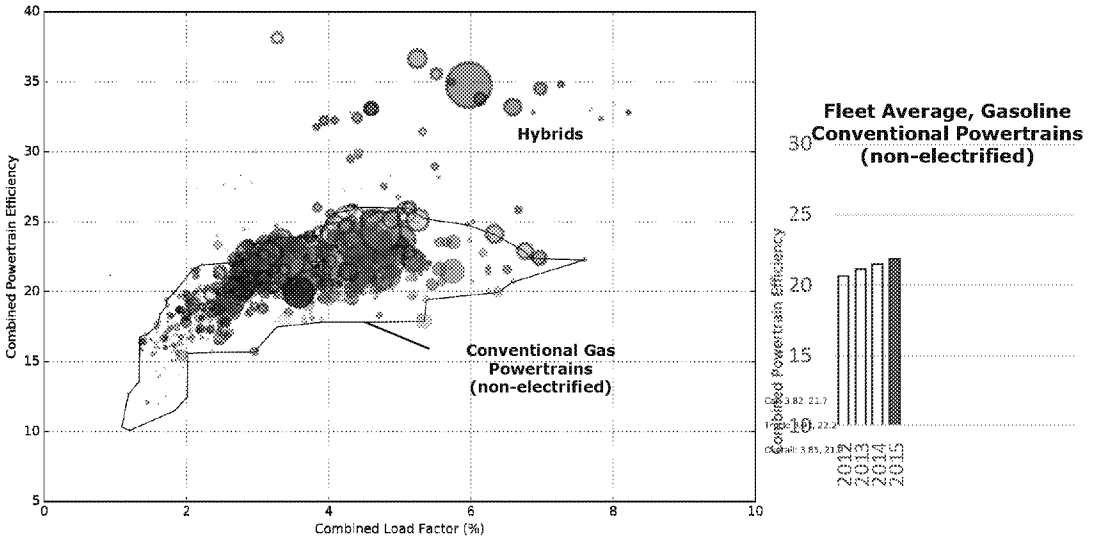
Distribution of Fleet Powertrain Efficiencies MY2013



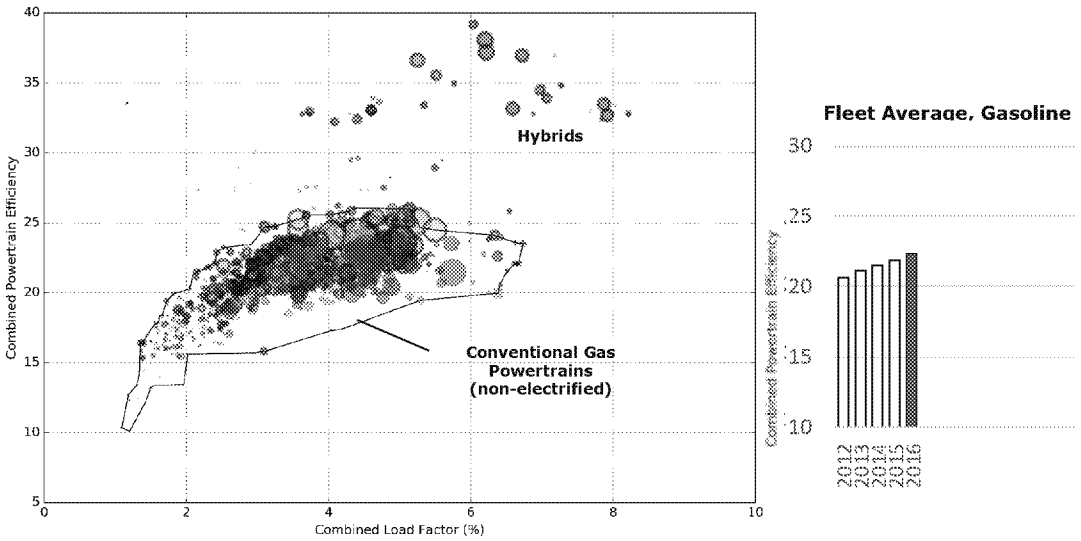
Distribution of Fleet Powertrain Efficiencies MY2014



Distribution of Fleet Powertrain Efficiencies MY2015

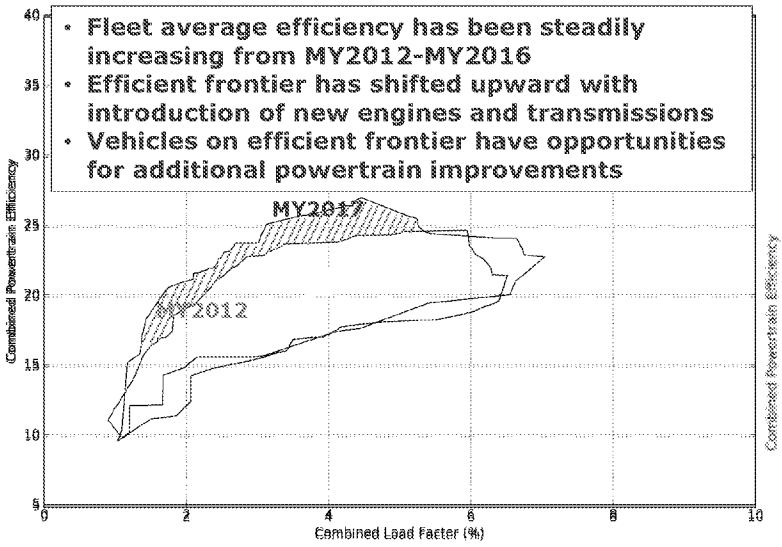


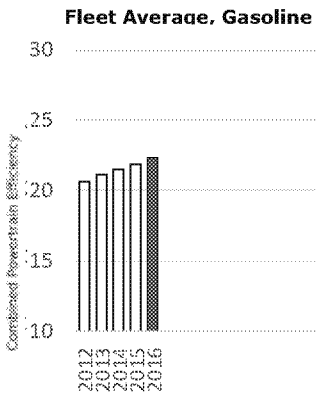
Distribution of Fleet Powertrain Efficiencies MY2016



Rate of Improvement in Fleet Powertrain Efficiencies MYs 2012 - 2016

- Fleet average efficiency has been steadily increasing from MY2012-MY2016
- Efficient frontier has shifted upward with introduction of new engines and transmissions
- Vehicles on efficient frontier have opportunities for additional powertrain improvements





Current Work on Incorporating ALPHA results into OMEGA

Ongoing MTE updates to EPA's Modeling Process for Technology Effectiveness

- **Stakeholders submitted comments for the Draft TAR and PD on the Lumped Parameter Model (LPM), including:**
  - Lack of transparency in the calibration of the LPM
  - Recommendation to incorporate ALPHA results more directly into OMEGA
- **EPA has initiated the peer review process of a revised methodology for integrating ALPHA modeling results into the OMEGA fleet compliance model**
  - Ongoing expansion of technology library and computational improvements enable direct ALPHA simulation for each of the ~1300 vehicles in the baseline fleet
  - Computational improvements allow full factorial modeling of future technology combinations
  - Full factorial modeling allows an automatic calibration of response surface equations for multiple future technology combinations, where the underlying data are directly tied to outputs from ALPHA full vehicle modeling.
- **The revised fleet compliance modeling methodology would be substantially similar to the previous methodology, but with a set of auto-calibrated response surface equations taking the place of the LPM.**